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WESSELSBRON DISEASE: A LITERATURE REVIEW

By Paul Ugstad and Robert Uskavitch[1]

SUMMARY

Wesselsbron disease, an infectious, noncontagious, arthropod-borne viral disease, occurs naturally in sheep and man. The disease causes abortions in pregnant ewes, deaths in newborn lambs, and manifests itself as a febrile influenzalike syndrome in man. Mosquitoes serve as the natural vector for the disease transmission.

The disease present on the African continent was initially isolated in the Union of South Africa in 1955. The clinical manifestations, pathology, and epizootiology closely resemble those of Rift Valley fever. The virus is suspected of causing abortions in cattle. Experimentally, cattle, horses, domestic swine, subhuman primates, mice, rabbits and guinea pigs have been infected. Fever, anorexia, and depression are seen in pregnant ewes and deaths in lambs. In man, fever and myalgia are the symptoms reported. Liver degeneration is the most common pathological finding. Mouse inoculation is utilized for confirmatory diagnosis. An attenuated virus vaccine has been developed for prophylaxis in cattle and sheep.

This publication presents a literature review of major references on Wesselsbron disease.

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HISTORY

An epizootic in a flock of sheep in the Wesselsbron district of the Orange Free State of the Union of South Africa was reported in the summer of 1954-55. Mortality of lambs less than 1 week old, abortions in ewes, and some deaths among ewes were observed. Since the flock had been vaccinated 2 weeks before the outbreak for Rift Valley fever, it was assumed that the attenuated vaccine virus was responsible. Weiss, Haig, and Alexander (32) isolated a virus similar but antigenically distinct from Rift Valley fever virus from the liver and brain of a lamb that had died from the disease.

Serologic testing of bovine sera showed the presence of infection in the Knysna area as early as January 1954 (32).

Smithburn and others (28) isolated the virus from the blood of a human suffering from a febrile illness in Tongaland, South Africa, and also from a suspension of wild-caught mosquitoes (32).

Among a population of 65,000 sheep in one river valley in South Africa 1,500 deaths were confirmed by virus isolation. The disease had occurred in the valley in 1956, the year previous to the epizootic.

Positive serum neutralization results have been obtained from a herd of cattle in which abortions had occurred (3).

GEOGRAPHIC DISTRIBUTION

Wesselsbron is quite widespread in the southern portion of the African continent. The virus has been isolated in South Africa, Uganda, the Cameroons (29), Rhodesia, Nigeria, and Thailand (1).

Serologic evidence of Wesselsbron virus has been found among humans in Mozambique (16), Kenya (9), and Uganda (12); among small and wild

ruminants in Chad and Cameroon (20); in domestic ungulates in Senegal (6); Madagascar, Botswana, Caprivi (1), Nyassaland, West Africa, Sudan, Ethiopia, Angola, and Bechuanaland (29).

VIRUS

Wesselsbron disease virus is a member of the group B Arboviruses (33). The virus is pantropic with a marked affinity for mammalian embryonal tissue (32) and also demonstrates hepatotropism and neutrotropism (13).

The size of the virus has been reported as 30 nm. (31), 34 nm. (26), 45 nm. (18), and 45 to 58 nm. (5).

As a group B Arbovirus, Wesselsbron virus is sensitive to ether and trypsin. The virus multiplies in the cytoplasm of infected cells and matures by budding from the cell membrane (33).

The virus is neutralized by antisera of Yellow Fever and Uganda S viruses (29). Monkeys infected with Wesselsbron virus show subsequent resistance to infection by Yellow Fever virus (11). Convalescent sera from humans with central European tickborne encephalitis showed hemagglutination-inhibition titer to Wesselsbron virus (29). The virus loses infectivity if subjected to ultracentrifugation (27).

VIRUS CULTIVATION

Wesselsbron virus grows in 8-day fertile chicken eggs, where mortality is low and irregular. The virus also propagates in lamb kidney cell cultures and produces intracytoplasmic inclusion bodies in infected cells (2). Plaque production will occur on primary inoculation into chick embryos (7) and also on tissue culture inoculation (19). The virus has a cytopathic effect on baby hamster kidney cells (15) and induces polykaryocyte formation when

added to cell cultures (8). Intracytoplasmic inclusion bodies are formed in secondary cultures of fetal lamb kidney cells (25).

Attenuation of the virus in fetal lamb kidney cells is accompanied by changes in the physical characteristics of the virus (26).

HOST RANGE

The disease has been shown to occur naturally in sheep and in man (32). Abortions in cattle probably occur naturally (2, 32).

Cattle, horses, and pigs have been experimentally infected and show mild to severe febrile response (32). Infant mice are susceptible to infection, fatalities being produced by either intraperitoneal or intracerebral inoculation (32). Adult mice, while susceptible to intracerebral inoculation, are refractory to infection by the intraperitoneal route. This is due to uncoating of the virus by mature (adult) macrophages (23). Guinea pigs and rabbits will abort when inoculated with virus, but adult nonpregnant animals show no apparent reaction (32). Rodents other than mice showed no evidence of infection or antibody production (21). Subhuman primates are susceptible (29). Wild ruminants may serve as reservoirs of infection in enzootic areas (20).

Many species of mosquitoes have been shown to carry the virus and are the natural vector for virus transmission. The species primarily responsible for transmission are *Aedes caballus* and *A. circumluteolus* (2). *Culex univattis* and *Taeniohynchus* (*Mansonia*) *uniformis* have been shown to carry virus; but transmission was not proved (17). Other mosquitoes in which Wesselsbron virus has been found are *Aedes minutus*, *A. lineatopennis*, *A. tarsalis*, *A. mediolineatus*, *Anapheles gambiae* and *An.pharoensis*, and *Culex telesilla* (1).

No clinical transmission from infected to susceptible animals has been shown (22). Experimentally, the disease can be transmitted via intravenous, intraperitoneal, intracerebral, and intranasal routes (22). Aerosol transmission has been incriminated in a confirmed case of Wesselsbron disease in a human laboratory worker (14).

CLINICAL SIGNS

The incubation period is undetermined naturally, ranging from 1 to 4 days experimentally.

In Sheep

Acute, subacute, and inapparent syndromes have been described.

In the acute form of Wesselsbron disease, which is seen in pregnant ewes and lambs, pyrexia, anorexia, apathy, and general weakness are seen, followed by abortions in the ewes (22). Blood-stained nasal discharges, melena, and paleness of mucous membranes may also be observed (13). Encephalitis signs are sometimes manifested in lambs before death (2).

Mortality approaches 100 percent in near-term feti and newborn lambs. In ewes, mortality is around 20 percent, including deaths from the disease and from secondary metritis and pregnancy toxemia (22).

The abortions may occur during the febrile period as a result of the fever. Feti aborted at this time are not infected. Later, the fetus will become infected and may be mummified, aborted, stillborn, or born alive and die shortly thereafter (13).

The subacute form of the disease in sheep is seen in weaned lambs, unbred ewes, rams, and wethers. There is pyrexia, anorexia, and depression lasting several days (22). Icterus and photodynamic dermatitis are also

seen (13). A mild, inapparent form may occur in which fever is the only sign. This form may result in temporary infertility in rams (22).

In Man

Naturally occurring cases of Wesselsbron disease in man have been mild consisting of fever, headache, pains in the back, bones, and joints, and disturbance of vision. Laboratory-acquired infections have been more severe. Subclinical infections are probably common (10).

In Cattle, Horses, and Pigs

Experimentally infected animals show febrile episodes without other signs (32). The virus probably causes abortions in cattle (2). Serum neutralization tests on cattle from a herd in which abortions had occurred were positive for Wesselsbron virus (3).

In Mice

Wesselsbron virus produces a fatal encephalitis in suckling mice by intracerebral or intraperitoneal inoculation and in adult mice by intracerebral inoculation (2).

In Rabbits and Guinea Pigs

Inapparent infections are produced in adult nonpregnant guinea pigs and rabbits by intraperitoneal inoculations of Wesselsbron virus. Pregnant guinea pigs and rabbits will abort or bear young that die within a few days (31).

GROSS PATHOLOGY

Acute and Peracute Cases

Icterus may or may not be present. There is extensive petechiation of

of fascia and larger hemorrhages of serosal surfaces. The abdominal and thoracic cavities contain blood-stained fluid. Pulmonary congestion may occur. There are severe hemorrhages within the lumen of the small or large intestine, with black tarry feces. The liver is swollen, firm and yellowish. The kidneys are swollen, soft, and dark (13). The spleen is enlarged (31).

Less Acute Cases

There is less extensive hemorrhage with some bleeding into the gut. Serous effusions stained by blood or bile are seen. Icterus is evident. The liver is striking, being golden-yellow in color and firm; the gall bladder is distended and dark with thick, occasionally jellylike bile. The blood is watery and orange in color, suggestive of intravascular hemolysis (13).

HISTOPATHOLOGY

Liver lesions include fatty degeneration with bile stasis and pigmentation, diffuse necrobiosis of hepatocytes, and leukocytic infiltration around central veins and in portal units. Inclusion bodies are unconstantly observed and their significance in undetermined (13). The spleen shows diffuse hemorrhages and congestion with hypoplasia of the malpighian bodies. The myocardium always shows congestion and petechiae (24). Other tissue show hemorrhages (13).

DIAGNOSIS

Diseases that may be confused clinically with Wesselsbron include Rift Valley fever, Nairobi sheep disease, bluetongue, and heartwater (22), heliotropium and bracken fern poisonings, and enterotoxemia (24).

Confirmation is by intracerebral and intraperitoneal inoculation of day-old and adult mice with ethylinediamine tetracetic acid (EDTA) preserved blood or 10 percent brain or liver suspension in sterile nutrient broth. Wesselsbron virus causes fatal encephalitis in suckling mice by both routes, while adults are fatally affected only by the intracerebral route. This differentiates Wesselsbron from Rift Valley fever, which causes fatalities in adult mice by both injection routes.

By using the liver or brain from fatalities thus produced, two separate groups of 2- to 5-day-old mice should be inoculated. One group should be protected with specific antiserum, the other group should remain unprotected (24). Neutralization testing by using cell cultures rather than mice has shown promise (30).

Convalescent serum can be tested by inoculating mice with serum and with known Wesselsbron virus. The serum, to be considered positive, should show 2 1/2 to 4 logs of neutralization (24).

Complement-fixation testing can be done by using standard antiserum and antigen prepared by acetone-ether or sucrose-acetone extraction methods from mouse brain or liver, or affected sheep liver, or aborted fetal brain (24).

PREVENTION

There is no known effective treatment. The use of insecticides on sheep may help to control insect vectors. Susceptible animals should not be introduced into enzootic areas, and known affected animals should not be transferred to areas free from the disease (22).

An attenuated virus vaccine of mouse brain and tissue culture origin, first developed in 1956 (4), is available for use in cattle and sheep. Animals

should be vaccinated in springtime to coincide with shearing and mating. Pregnant animals should not be vaccinated (22).

IMMUNITY

Animals that have recovered from Wesselsbron disease develop solid immunity which probably lasts for life. Since attenuation of the virus for vaccination may alter its immunogenicity, annual boosters are recommended (22).

LITERATURE CITED

(1) American Committee on Arthropod-borne Viruses. Subcommittee on Information Exchange.
1975. Catalogue on arthropod-borne viruses of the world; a collection of data on registered arthropod-borne animal viruses. Ed. by N. Karabatsos, CDC, Fort Collins, Colo., 359 registered cards.

(2) Andrewes, Sir C., and Pereira, H.G.
1972. Viruses of vertebrates. 3d ed. Bailliere Tindall, London, 451 pp.

(3) Belonje, C.W.A.
1959. Field observations on Wesselsbron disease. J.S. Afr. Vet. Med. Assoc. 29: 1-12.

(4) Cabasso, V.J.
1971. Viral vaccines against animal diseases - past, present and future. In Viruses affecting man and animals: 430-453. Ed. by M. Sanders and M. Schaeffer. Green, St. Louis, Mo., 459 pp.

(5) Casals, J.
1971. Arboviruses: incorporation in a general system of virus classification. In Comparative virology: 307-333. Ed. by K. Maramorosch and E. Kurstak. Academic Press, New York, N.Y., 584 pp.

(6) Chunikhin, S.P., Karaseva, P.S., Tofflib, R., and others.
1971.. (Results of serological study of circulation cycles of some arboviruses in the Republic of Senegal (West Africa).) Vopr. Virusol. 16: 52;55. Biol. Abstr. 52: 11058 (110842)

(7) Cooper, P.D.
1967. The plaque assay of animal viruses. In Methods in virology 3: 243-311. Ed. by K. Maramorosch and H. Koprowski. Academic Press, New York, N.Y., 677 pp.

(8) Djinawi, N.K., and Olson, L.C.
1973. Cell fusion induced by Germiston and Wesselsbron viruses. Arch. Gesamte Virusforsch. 43: 144-151.

(9) Geser, A., Henderson, B.E., and Christensen, S.
1970. A multipurpose serological survey in Kenya. 2. Results of arbovirus serological tests. Bull. World Health Organization 43: 539-552.

(10) Goldblum, N.
1964. Group B arthropod-borne viral diseases. Mosquito-borne viral diseases. First subgroup:SJE, JBE, MVE-WNE complex. In Zoonoses: 356-393. Ed. by J. vander Holden. Elsevier, New York, N.Y. 774 pp.

(11) Henderson, B.E., Cheshire, P.P., Kirya, G.B., and others.
1970. Immunologic studies with yellow fever and selected African group B arboviruses in rhesus and vervet monkeys. Am. J. Trop. Med. Hyg. 19: 110-118.

(12) Henderson, B.E.,Kirya, G.B., and Hewitt, L.E.
1970. Serological survey for arboviruses in Uganda, 1967-69. Bull. World Health Organization 42: 797-805.

(13) Jubb, K.V.F., and Kennedy, P.C.
1970. Pathology of domestic animals 2. 2d ed. Academic Press, New York, N.Y., 697 pp.

(14) Justines, G.A., and Shope, R.E.
1969. Wesselsbron virus infection in a laboratory worker, with virus recovery from a throat washing. Health Lab. Sci. 6: 46-49.

(15) Karabatsos, N., and Buckley, S.M.
1967. Susceptibility for the baby-hamster kidney-cell line (BHK-21) to infection with arboviruses. Am. J. Trop. Med. Hyg. 16: 99-105.

(16) Kokernot, R.H., Smithburn, K.C., Gandara, A.F., and others.
1960. (Neutralization tests for arboviruses in residents of Mozambique.) An. Inst. Med. Trop. (Lisb.) 17: 201-230.

(17) Kokernot, R.H., Smithburn, K.C., Paterson, H.E., and others.
1960. Further isolation of Wesselsbron virus from mosquitoes. S. Afr. Med. J. 34: 871-874.

(18) Lecatsas, G., and Weiss, K.E.
1969. Formation of Wesselsbron virus in BHK-21 cells. Arch. Gesamte Virusforsch. 27: 332-338.

(19) Madrid, A.T. de, and Porterfield, J.S.
1969. A simple micro-method for the study of group B arboviruses. Bull. World Health Organization 40: 113-121.

(20) Maurice, Y., and Provost, A.
1969. Serological surveys about animal arboviruses in Central Africa (Horse sickness, bluetongue, Wesselsbron disease, Rift Valley fever). Rev. Elev. Med. Vet. Pays Trop. 22: 179-184.

(21) McIntosh, B.M.
1961. Susceptibility of some African wild rodents to infection with various arthropod-borne viruses. Trans. R. Soc. Trop. Med. Hyg. 55: 63-68.

(22) Neitz, W.O.
1966. Wesselsbron disease. In Food and Agriculture Organization Office International des Epizooties International meeting on sheep diseases. Working paper no. 42.

(23) Olson, L.C., Sithisarn, P., and Djinawi, N.K.
1975. Role of macrophages in Wesselsbron and germiston virus infections of mice. J. Infect. Dis. 131: 119-128.

(24) Oxer, D.T.
1972. Exotic diseases of animals, a manual for diagnosis. Aust. Gov. Publ. Serv., Canberra, 135 pp.

(25) Parker, J.R., and Stannard, L.M.
1967. Intracytoplasmic inclusions in foetal lamb kidney cells infected with Wesselsbron virus. (Brief report). Arch. Gesamte Virusforsch. 26: 469-472.

(26) Parker, J.R., Wouters, A.G., and Smith, M.S.
1969. Physical changes of Wesselsbron virus occurring during attenuation in foetal lamb kidney cells. Arch. Gesamte Virusforsch. 26: 305-320.

(27) Polson, A.
1971. New Approaches to Ultracentrifugation. In Methods in Virology 5: 33-77. Ed. by K. Maramorosch and H. Koprowski. Academic Press, New York, N.Y., 530 pp.

(28) Smithburn, K.C., and others.
1957. Studies on Arthropod-borne Viruses of Tongaland. IX. Isolation of Wesselsbron Virus from a Naturally Infected Human Being and from Aedes (Bank sinelia) circumlutealus Theo. S. Afr. J. Med. Sci. 22: 113-120. Biol. Abstr. 33: 2175 (26758).

(29) Theiler, M. and Downs, W.G.
1973. In The Arthropod-borne Viruses of Vertebrates. Yale University Press:New Haven, Conn., 578 pp.

(30) Way, H.J., Bowen, E.T.W., and Platt, G.S.
1976. Comparative Studies of Some African Arbovirus in Cell Studies for some African arboviruses in cell culture and in mice. J. Gen. Virol. 30: 123-130.

(31) Weiss, K.E.
1957. Wesselsbron Virus Disease. Bull. Epizoot. Dis. Afr. 5: 459-465.

(32) Weiss, K.E., Haig, D.A., and Alexander, R.A.
1956. Wesselsbron virus - a virus not previously described, associated with abortion in domestic animals. Onderstepoort J. Vet. Res. 27: 183-195.

(33) Wildy, P.
1971. Classification and nomenclature of viruses; first report of the International Committee on Nomenclature of Viruses. In Monographs in virology 5: 81 pp. Ed. by J.L. Melnick. S. Karger, New York, N.Y.

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